agriculture

research findings for development policymakers and practitioners

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In this issue

Why do rice farmers in Bangladesh ignore recommendations on pesticide use?

Pesticide use by rice farmers in Bangladesh is low compared with many Asian countries. However, it is increasing and becoming excessive in some places. Why do some farmers overuse pesticides, despite their cost and well-known negative impacts?

Research from the Natural Resources Institute at the University of Greenwich, in the UK, looks at farmers' motivations for using pesticide in two regions of Bangladesh. Scientists had confirmed that local farmers were using too much pesticide in both regions. They were particularly concerned at the common use of 'precautionary pesticides' – a pesticide that is applied before a pest attack occurs.

The researchers assessed both farmers' knowledge of pests, their perceptions of pest damage and their perceptions about the benefits of pesticides. These farmers included some who had received training in integrated pest management (IPM) and others who had not had any pest management training.

The researchers found that trained farmers are more likely to recognise natural enemies to pests than untrained farmers. However, about half of all the farmers surveyed use the precautionary pesticide approach. Many adapt recommendations for pesticide use, according to how much cash or credit they have and their perception of the pest problem. Furthermore:

- Few, if any, trained farmers practice IPM techniques because they consider them risky and labour intensive. They also tend to forget the techniques involved.
- In contrast, pesticides are easy to access and use, with low labour requirements.
- Untrained farmers tend to obtain information about pesticides from pesticide dealers, some of whom also provide credit and encourage the use of precautionary pesticides.
- Farmers who use precautionary pesticides lose their ability to determine how often and how severe pest attacks are, and tend to overestimate the damage caused by pests.
- Both trained and non-trained farmers know that pesticides are harmful to human health, yet many continue to overuse them.
- Although trained farmers understand the connection between pesticide use and environmental damage, few acknowledge that this might relate to their own livestock and fish production.

For poor farmers facing uncertain harvests, the perceived short-term benefits of pesticides far outweigh any long-term negative impacts. Therefore, relying solely on education concerning the health and environmental problems associated with pesticides is unlikely to have a large impact in the region studied. Understanding why farmers use pesticide is the key to making training more effective and increasing the use of appropriate pest management practices.

For poor farmers facing uncertain harvests, the perceived short-term benefits of pesticides far outweigh any long-term negative impacts

The researchers make the following recommendations to policymakers and pest management experts:

- Classify farmers into different types according to their motivations and constraints (such as a lack of credit) and adapt training courses accordingly.
- Increase efforts to reach untrained farmers and help them to enrol on training courses.
- Provide simple pest management rules that are easy to remember and apply, with refresher training to help farmers retain this knowledge.
- Emphasise the negative impacts of pesticide use on farmers' other activities.
- Develop and prioritise low-labour alternatives to compete with pesticides.

Elizabeth Robinson, **Sumona Rani Das** and **Tim Chancellor**
Elizabeth Robinson, Environment for Development Tanzania, Department of Economics, University of Dar es Salaam, Box 34045, Tanzania
T +255 713 355700 **ejzrobinson@hotmail.com**

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Exchanging seeds and conserving biodiversity in Mexico

Getting secure access to seeds of the right variety and quality is an important issue for farmers and is central to achieving food security. How do farmers in Mexico ensure access to the right seeds?

Mexico is a centre of diversity for maize, and farmers play a key role in maintaining this. The dynamics of farmers' seed supply practices have important implications, both for the conservation of genetic crop resources and for the design of conservation interventions. Research from the International Maize and Wheat Improvement Center in Mexico examines the factors that influence farmers' local seed transactions in the Central Valleys of Oaxaca State.

Farmers in Oaxaca value traditional maize varieties. A formal seed retail sector has yet to develop in the region. Most farmers produce their own seeds or sometimes get them from other farmers. Seeds are carefully selected from farmers' own harvests, with the farmer trying to maximise the best features of the variety. Seeds are also inherited, passing from parents to their children when they start farming independently.

Many farmers also like to try out other kinds of maize seeds, mix them with seeds from their own harvest and experiment with different varieties that work in different conditions. Understanding the dynamics of how seeds are exchanged gives important clues to the factors that shape the evolution and conservation of genetic diversity.

The research shows:

- The majority of seed transactions take place between people who already know each other. Farmers can find the seeds they need at low cost and risk.
- Trust is a key issue in seed transactions. Farmers generally prefer seed providers who are easy to approach and who might be willing to exchange seeds for free.
- They also need to trust the provider's information about the environmental conditions where the seed originated.
- Experimentation and curiosity are a motive for acquiring new seeds. Farmers often try out seed materials that they come across, seeing how 'foreign' seeds could acclimatise to local conditions.
- Analysis of the genetic structure of local maize shows that human selection plays a key role in creating and maintaining different types of maize.
- A strong sense of social responsibility and mutual assistance is central to seed exchanges. For 69 percent of farmers, the most important reason for distributing their own seeds was to help the recipient.

Farmer-to-farmer seed flows are important in genetic conservation and in spreading new information about innovations and technologies. What can be learned from their ways of exchanging seed?

- Access to trustworthy information about seeds is a key issue in smallholder seed transactions.
- Development interventions, whether for conservation or for introducing new seeds, should explore the possibilities for building on existing social organisations, rather than creating new organisations dedicated specifically to seed supply.

L Badstue, **M Bellon** and **J Berthaud**
Lone Badstue, African Water Facility, African Development Bank, Tunis, Tunisia
T +216 71102733 **F** +216 71103744
lone.badstue@gmail.com

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Could agriculture help to prevent further climate change?

There is growing evidence that greenhouse gas emissions from human activity contribute to climate change. Many people blame modern farming practices for accelerating this – agriculture produces between 16.8 and 32.2 percent of global greenhouse gas emissions. But could agriculture also hold some solutions to climate change?

Research for Greenpeace International by the University of Aberdeen, in the UK, analyses the contribution of modern farming to human-induced climate change. The main greenhouse gases (GHGs) associated with agriculture are nitrous oxide and methane. GHG emissions from farming include direct sources, such as soil and livestock, and indirect emissions. These include fossil fuel use, fertiliser production and changes in land use, particularly the expansion of agriculture into uncultivated areas such as tropical forests.

All farming systems emit GHGs, with intensive farming producing more emissions per area, but not necessarily per unit of product. Globally, livestock are the main source of methane, and intensive animal farming also increases the demand for feed crops and synthetic fertilisers.

Economic growth in the developing world is increasing the demand for meat, as more people can afford it. The greatest increase in meat consumption has occurred in developing countries – 77 percent from 1960 to 1990. Even without these dietary changes, the growing population in developing countries is increasing the demand for food and more intensive farming.

- From 1990 to 2005, developing countries and countries in economic transition collectively showed a 32 percent increase in GHG emissions.
- By 2005, these countries were responsible for about three quarters of global agricultural emissions.
- Three sources together contribute 88 percent of this increase: methane from livestock, soil nitrous oxide emissions and biomass burning.
- Between 2001 and 2004, the rising demand for beef and high energy feed crops (especially soya) led to the deforestation of 93,700 square kilometres of rainforest in Brazil.
- Among developing countries, China and India are the main drivers behind the increased use of fertilisers and manure to meet demands for food, caused by rapid population growth.

Despite these problems, agriculture has the potential to reduce the impact of almost all its direct emissions (known as mitigation). The researchers suggest that 89 percent of agriculture's mitigation contribution will come from soil carbon sequestration (the removal and long-term storage of carbon from the atmosphere using soil as a natural carbon sink). In the short term, the most important measure is to avoid deforestation, especially in tropical countries.

The researchers suggest other ways in which the GHG emissions from agriculture can be mitigated:

- avoid bare soil and rotate crops with legumes such as peas and beans – these fix nitrogen in the soil and reduce reliance on fertilisers
- reduce tillage (preparing soil by digging it up) to restore the carbon content of degraded soils and reduce soil disturbance
- avoid burning crop residues
- practise agro-forestry (growing trees on farming land for timber and other forest products)
- adopt a vegetarian diet or at least reduce meat consumption.

Jessica Bellarby, **Bente Foereid**, **Astley Hastings** and **Pete Smith**
Pete Smith, School of Biological Sciences, University of Aberdeen, Cruickshank Building, St Machar Drive, Aberdeen AB24 3UU, UK
T +44 1224 272702 **F** +44 1224 272703
pete.smith@abdn.ac.uk

Greenpeace International, Ottho Heldringstraat 5, 1066 AZ Amsterdam, The Netherlands
T +31 20 7182000 **F** +31 20 5148151
supporter.services@int.greenpeace.org

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The impacts of improved accessibility on livestock management in Pakistan

The northern region of Pakistan has seen rapid infrastructure development in recent years. In particular, the construction of the Karakoram Highway has created a major transport link through the region. What impact have these improved communications had on livestock management systems?

Most people in Pakistan's northern region have small farms and keep livestock. This region lies at the junction of the Karakoram, Western Himalayan and Hindu Kush mountain ranges. Research led by the Macaulay Institute, in the UK, investigates the impact of improved accessibility on local livestock management practices and production systems.

Smallholders practice an integrated agro-pastoral system that combines livestock production with arable crop farming but increases in human population density are putting pressure on the local farming system and local pastures

The researchers measured crop areas and livestock numbers on two transects – paths along which one records and counts occurrences. The first transect was along the Karakoram Highway (KKH). The other transect was in the Gilgit-Ghizer Region (GGR) and lay along a valley with little transport infrastructure. The main difference between the transects is the quality of the roads, which are high in the KKH transect and low in the GGR transect.

The researchers surveyed 59 smallholder households in detail and completed a broader survey of 130 households. The study found that smallholders in the region practice an integrated agro-pastoral system, combining livestock production with arable crop farming. However, increases in human population density are putting pressure on the local farming system and on local pastures.

Further research findings show:

- Herd sizes were similar across both transects.
- Livestock are primarily kept for domestic milk supply and a source of manure and butter (ghee), as well as for generating some cash income.
- The improved accessibility in the KKH transect only caused a slight difference in livestock management practices.
- There were 42 percent more cross-bred and therefore 'improved' cattle and sheep in the KKH transect.
- In the GGR transect, there was more trade in livestock and a greater use of animals for ploughing.
- Insufficient winter food for livestock was the most significant constraint across both transects; however, farmers in the KKH transect stored significantly more feed than those in the GGR transect.
- There was a greater emphasis on cash crops, such as peas and potatoes, in the KKH transect.
- Off-farm employment and the level of formal education were also higher in the KKH transect.

Upgrading low quality roads has had relatively little impact on traditional livestock management practices. However, households in lower altitude zones and those close to better transport and communication infrastructure in the KKH transect appear to be less dependent on livestock for income. This suggests that livestock continues to be important in household economies, even if infrastructure develops, but becomes less important in terms of earning money.

The researchers make several recommendations:

- Development efforts should focus on improving the marketing aspects of livestock production to increase cash income from livestock products.
- Increasing the allocation of labour to cash crops and increasing the amount of time spent on education may leave less labour and time for tending animals on high pastures under the traditional management system.
- Further research should focus on this issue, since livestock grazing is important to maintaining the integrity of these fragile pasture resources.

Abdur Rahman, **Alan J Duncan**, **David W Miller**, **Juergen Clemens**, **Pilar Frutos**, **Iain J Gordon**, **Atiq-ur Rehman**, **Ataullah Baig**, **Farman Ali** and **Iain A Wright**
Alan J Duncan, International Livestock Research Institute, PO Box 5689, Addis Ababa, Ethiopia
T +251 11 6172223 **F** +251 11 6172001 **a.duncan@cgiar.org**

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A livestock farmer in the Hindu Kush-Karakoram-Himalayan region of Pakistan
©Grant Davidson, 2006

Shaping scientific excellence in agricultural research

Science and technology are central to development in Africa. But scientific solutions to development problems are not always appropriate to the places where the problems arise. How can scientists be supported to develop appropriate, innovative and sustainable solutions to problems?

Researchers from the University of Edinburgh and the Open University, both in the UK, suggest that finding solutions in agriculture and poverty should involve scientists from several disciplines working together. Solutions should also involve development partnerships and networks. Peer review publications, the traditional tool of scientific excellence, do little to promote researchers from different disciplines working together in partnership.

This is illustrated by examining research into two African cattle diseases, East Coast Fever (ECF) and trypanosomiasis, at the International Livestock Research Institute. Since the late 1970s, approaches to researching these diseases have changed significantly.

At first, scientists were based in laboratories, searching for vaccines. But after fifteen years of effort and high quality scientific research, it became clear that vaccines were not going to provide simple solutions.

It was impossible to produce a trypanosomiasis vaccine. Dealing with the flies that transmit the disease was an alternative approach to fighting it. This alternative was largely ignored during the period of exclusive focus on vaccines, and opportunities to develop research along these lines were missed.

Although a vaccine for ECF has been developed, it is expensive to produce and deliver. Vaccinated animals need monitoring after treatment, and they can sometimes become carriers of the parasite that spreads the disease. ECF vaccine research continues, but donor requirements have shaped a very different approach.

Approaches to researching East Coast Fever and trypanosomiasis have changed significantly; after fifteen years of high quality scientific research, it became clear that vaccines were not going to provide simple solutions

- Research funding is now based on an assessment of the impact the ECF vaccine could have on livelihoods and economies. The regional economy of East Africa loses about £300 million each year because of ECF.
- The steps needed to make the ECF vaccine work in practice are just as important as continuing laboratory work.
- A system to effectively disseminate the vaccine to those who need it is an integral part of the research programme.
- A network of partners, including private sector biotechnology companies, has played an important role in moving ECF vaccination science forward.

The way that scientific excellence is defined is central to shaping decisions about funding, donor activities and research agendas. Experience with vaccines shows that something more systematic than excellent laboratory-based research is needed to produce concrete disease control technologies. This means involving a wider range of partners in scientific research, and beginning to change the way that scientific excellence is defined and understood.

- The shift away from science-led approaches to development problems implies the need for research institutions to organise themselves differently.
- The meaning of excellence must change to incorporate objectives such as focused problem-solving.
- Development policy must focus on systemic approaches to research problems.
- Understanding the context of problems is central to developing effective solutions.
- New systems for evaluation will be needed if systemic approaches are more widely adopted.

Joanna Chataway, **James Smith** and **David Wield**
Joanna Chataway, ESRC Innogen Centre, Open University, Milton Keynes MK7 6AA, UK
T +44 1908 654782 **F** +44 1908 654825
j.c.chataway@open.ac.uk

James Smith, ESRC Innogen Centre, Institute for the Study of Science, Technology and Innovation, The University of Edinburgh, Old Surgeons' Hall, High School Yards, Edinburgh EH1 1LZ, UK
F +44 131 6506535
james.smith@ed.ac.uk

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id21
Institute of Development Studies
University of Sussex, Brighton, BN1 9RE, UK
T +44 1273 678787 **F** +44 1273 877335 **email** id21@ids.ac.uk

id21
Institute of Development Studies
University of Sussex
Brighton, BN1 9RE UK

T +44 1273 678787
F +44 1273 877335
E id21@ids.ac.uk

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